CLAIMS

What is claimed is:

1. An horological device comprising:

discharging means for discharging a stored electrostatic charge in a charge storage element in a time cell in the horological device using a discharge process with a predetermined discharge rate, wherein the charge storage element comprises an internal medium for storing an electrostatic charge and an insulating medium for insulating the internal medium that substantially surrounds the internal medium, and wherein the time cell transitions from a non-time-measuring state to a time-measuring state in the horological device upon receiving the electrostatic charge; and

detection means for detecting a current level of electrical potential at the charge storage element within an elapsed time period after storing the electrostatic charge.

2. The horological device of claim 1 further comprising:

conversion means for converting the detected level of electrical potential to an elapsed time period value representing an amount of time since storing the electrostatic charge.

3. The horological device of claim 2 wherein a length of the elapsed time period varies with an initial condition of the horological device after storing an electrostatic charge in the charge storage element.

4. The horological device of claim 3 wherein the initial condition of the horological device is determined by an initial electrical potential of the charge storage element after storing an electrostatic charge in the charge storage element.

5. The horological device of claim 1 further comprising:

a time detection unit for processing a time request to generate a time response after reading the time cell.

6. A method for measuring time with an horological device, the method comprising:

discharging a stored electrostatic charge in a charge storage element in a time cell in the horological device using a discharge process with a predetermined discharge rate, wherein the charge storage element comprises an internal medium for storing an electrostatic charge and an insulating medium for insulating the internal medium that substantially surrounds the internal medium, and wherein the time cell transitions from a non-time-measuring state to a time-measuring state in the horological device upon receiving the electrostatic charge; and

detecting a current level of electrical potential at the charge storage element within an elapsed time period after storing the electrostatic charge.

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7. The method of claim 6 further comprising:

converting the detected level of electrical potential to an elapsed time period value representing an amount of time since storing the electrostatic charge.

8. The method of claim 7 wherein the elapsed time period value is a number of time units representing the elapsed time period.

9. The method of claim 7 wherein the elapsed time period value is a boolean value representing whether or not the elapsed time period value is greater than a specified time period value.

10. The method of claim 6 further comprising:

reading at least one time cell in an array of time cells.

11. The method of claim 10 wherein at least one time cell in the array of time cells has a predetermined discharge rate that differs from a predetermined discharge rate of another time cell in the array of time cells.

12. The method of claim 10 wherein at least two time cells in the array of time cells have substantially identical predetermined discharge rates.

13. The method of claim 10 further comprising:

controlling the array of time cells through a time cell interface unit by reading one or more time cells in the array of time cells.

14. The method of claim 10 further comprising:

processing a time request through a time detection unit to generate a time response after reading one or more time cells within the array of time cells.

15. A computer program product on a computer readable medium for use in a data processing system for measuring time with an horological device, the computer program product comprising:

instructions for receiving a time measurement request for the horological device; and

instructions for detecting a current level of electrical potential at a charge storage element in a time cell in the horological device within an elapsed time period after storing an electrostatic charge in the charge storage element, wherein the charge storage element comprises an internal medium for storing an electrostatic charge and an insulating medium for insulating the internal medium that substantially surrounds the internal medium, and wherein the time cell transitions from a non-time-measuring state to a time-measuring state in the horological device upon receiving the electrostatic charge, and wherein the stored electrostatic charge discharges from the charge storage element using a discharge process with a predetermined discharge rate.

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16. The computer program product of claim 15 further comprising:

instructions for converting a detected level of electrical potential at the charge storage element to an elapsed time period value representing an amount of time since storing the electrostatic charge.

17. The computer program product of claim 16 wherein the elapsed time period value is a number of time units representing the elapsed time period.

18. The computer program product of claim 16 wherein the elapsed time period value is a boolean value representing whether or not the elapsed time period value is greater than a specified time period value.

19. The computer program product of claim 15 further comprising:

instructions for reading at least one time cell in an array of time cells.

20. The computer program product of claim 19 wherein at least one time cell in the array of time cells has a predetermined discharge rate that differs from a predetermined discharge rate of another time cell in the array of time cells.

21. The computer program product of claim 19 wherein at least two time cells in the array of time cells have substantially identical predetermined discharge rates.

22. The computer program product of claim 19 further comprising:

instructions for controlling the array of time cells through a time cell interface unit by reading one or more time cells in the array of time cells.

23. The computer program product of claim 19 further comprising:

instructions for processing a time request through a time detection unit to generate a time response after reading one or more time cells within the array of time cells.

24. An horological device comprising:

an internal medium for storing an electrostatic charge;

an insulating medium for insulating the internal medium, the internal medium and the insulating medium forming a charge storage element,

wherein the insulating medium substantially surrounds the internal medium;

wherein the insulating medium has physical properties that allow a charging process for charging the internal medium with an electrostatic charge through the insulating medium;

wherein the insulating medium has physical properties that allow a discharge process for discharging a stored electrostatic charge from the internal medium through the insulating medium;

wherein the insulating medium has one or more physical properties that affect a rate of discharge in the discharge process; and

wherein at least one physical property of the insulating medium has been selected so that the discharge process discharges a stored

electrostatic charge at a predetermined discharge rate;

an electrostatic detector physically coupled to the charge storage element for allowing a detection of an electrical potential of the internal medium caused by a retained electrostatic charge in the internal medium; and

a time detection unit for determining an elapsed time period of a programmed charge storage element by operating the electrostatic detector.

25. The horological device of claim 24 further comprising:

a conversion unit for converting a detected electrical potential of a charge storage element to an elapsed time value after operating the electrostatic detector.

26. The horological device of claim 25 further comprising:

a request processing unit for processing requests for an elapsed time period.

27. The horological device of claim 25 further comprising:

a time generating unit for generating a time value in response to a request for determining an elapsed time period.

28. The horological device of claim 24 wherein the charge storage element is a floating gate in a floating gate field effect transistor.

29. A method for measuring time in an horological device, the method comprising:

discharging a stored electrostatic charge within a charge storage element, wherein the charge storage element comprises an internal medium for storing an electrostatic charge and an insulating medium for insulating the internal medium,

wherein the insulating medium substantially surrounds the internal medium;

wherein the insulating medium has physical properties that allow a charging process for charging the internal medium with an electrostatic charge through the insulating medium;

wherein the insulating medium has physical properties that allow a discharge process for discharging a stored electrostatic charge from the internal medium through the insulating medium;

wherein the insulating medium has one or more physical properties that affect a rate of discharge in the discharge process; and

wherein at least one physical property of the insulating medium has been selected so that the discharge process discharges a stored electrostatic charge at a predetermined rate; and

detecting an electrical potential of the internal medium through an electrostatic detector physically coupled to the charge storage element in order to determine an

elapsed time since the charge storage element was programmed.

30. The method of claim 29 further comprising:

converting a detected electrical potential of a charge storage element to an elapsed time value.

31. The method of claim 29 further comprising:

processing requests to determine an elapsed time period.

32. The method of claim 31 further comprising:

generating a time value in response to a request for determining an elapsed time period.

33. The method of claim 29 wherein the charge storage element is a floating gate in a floating gate field effect transistor.

34. A method for measuring time comprising:

discharging a stored electrostatic charge in a floating gate in a first floating gate field effect transistor, wherein the first floating gate field effect transistor comprises a floating gate and an insulating region of insulating material adjacent to the floating gate, wherein the floating gate discharges through a second floating gate field effect transistor, wherein a portion of the floating gate is common to the first floating gate field effect transistor and the second floating gate field effect transistor, wherein a discharge rate of a discharge process that discharges an electrostatic charge stored within the

programmed floating gate is inversely related to a thickness of the insulating region, and wherein the thickness of the insulating region is selected such that a threshold voltage of the second floating gate field effect transistor has a predetermined decay rate after programming the floating gate; and

performing a read operation on the second floating gate field effect transistor to determine its current threshold voltage.

35. The method of claim 34 wherein the predetermined decay rate varies with an initial threshold voltage of the second floating gate field effect transistor after programming the floating gate.

36. The method of claim 34 further comprising:

converting the detected threshold voltage to an elapsed time period value representing an amount of time since storing the electrostatic charge.

37. A reading device comprising:

coupling means for coupling, to the reading device, an article of manufacture, wherein the article of manufacture comprises an analog time cell; and

reading means for reading the article of manufacture.

38. The reading device of claim 37 wherein the analog time cell transitions from a non-time-measuring state to a time-measuring state upon storing an electrostatic charge.

39. The reading device of claim 37 wherein the article of manufacture is a smart card.

40. The reading device of claim 37 further comprising:

time determining means for determining an elapsed time period since the analog time cell was programmed.